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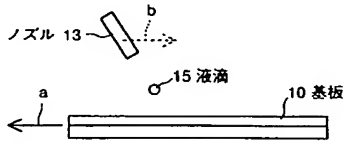
(54)【発明の名称】液晶表示装置の製造装置および製造方法

(57)【要約】
【課題】スペーサを含む液滴を基板の非画素領域内に収まるように塗布でき、表示品位の高い液晶表示装置を製造できる液晶表示装置の製造装置および製造方法を提供すること。
【解決手段】基板１０をほぼ水平状態で保持し、スペーサ１４を含む液滴１５を、傾斜設置されたノズル１３により基板上１０の非画素領域１２に吐出する。この吐出行程ごとに基板１０側を所定ピッチで走査し、基板１０に付着した液滴１５が、非画素領域１２が延在する方向に沿ってほぼ楕円形状となるように吐出する構成とした。
【選択図】　図１



【特許請求の範囲】
【請求項１】
スペーサを含む液滴を液滴吐出法を用いて基板に吐出し、当該スペーサを当該基板上に配置する液晶表示装置の製造装置において、
前記基板をほぼ水平状態で保持する基板保持手段と、
前記基板の法線に対して一定角度傾斜させて配置され、前記スペーサを含む前記液滴を当該基板上の非画素領域に吐出するノズル手段と、
前記基板または前記ノズル手段の少なくとも一方を所定量移動させる走査手段と、
を備え、
前記ノズル手段から吐出され前記基板に付着した前記液滴が、前記非画素領域が延在する方向に沿って広がるように吐出することを特徴とする液晶表示装置の製造装置。
【請求項２】
前記ノズルの設置角度を任意に変更するノズル角可変手段を備えたことを特徴とする請求項１に記載の液晶表示装置の製造装置。
【請求項３】
前記ノズルの設置角度を基板の法線に対して－２０°～－８０°の範囲のうちのいずれかの角度、または＋２０°～＋８０°の範囲のうちのいずれかの角度としたことを特徴とする請求項１または２に記載の液晶表示装置の製造装置。
【請求項４】
前記ノズル手段の位置を固定し、前記液滴の運動量の吐出方向水平成分と逆方向に前記基板を移動しながら当該ノズル手段から前記液滴を吐出することを特徴とする請求項１～３のいずれか一つに記載の液晶表示装置の製造装置。
【請求項５】
前記基板の位置を固定し、前記液滴の運動量の吐出方向水平成分と同方向に前記ノズル手段を移動しながら当該ノズル手段から前記液滴を吐出することを特徴とする請求項１～３のいずれか一つに記載の液晶表示装置の製造装置。
【請求項６】
前記液滴の運動量の吐出方向水平成分と逆方向に前記基板を移動し、かつ、前記液滴の運動量の吐出方向水平成分と同方向に前記ノズル手段を移動しながら当該ノズル手段から前記液滴を吐出することを特徴とする請求項１～３のいずれか一つに記載の液晶表示装置の製造装置。
【請求項７】
スペーサを含む液滴を液滴吐出法を用いて基板に吐出し、当該スペーサを当該基板上に配置する液晶表示装置の製造方法において、
基板保持手段によって前記基板をほぼ水平状態で保持した後、
前記基板の法線に対して一定角度傾斜させて配置されたノズル手段によって前記スペーサを含む前記液滴を当該基板上の非画素領域に吐出し、
前記基板または前記ノズル手段の少なくとも一方を所定量移動させ、前記液滴の吐出行程を所定回数繰り返すことにより、前記スペーサを前記非画素領域に配置するようにしたことを特徴とする液晶表示装置の製造方法。
【請求項８】
前記ノズル手段の位置を固定し、前記液滴の運動量の吐出方向水平成分と逆方向に前記基板を移動しながら当該ノズル手段から前記液滴を吐出することを特徴とする請求項７に記載の液晶表示装置の製造方法。
【請求項９】
前記基板の位置を固定し、液滴の運動量の吐出方向水平成分と同方向に前記ノズル手段を移動しながら当該ノズル手段から前記液滴を吐出することを特徴とする請求項７に記載の液晶表示装置の製造方法。
【請求項１０】
前記液滴の運動量の吐出方向水平成分と逆方向に前記基板を移動し、かつ、前記液滴の運

動量の吐出方向水平成分と同方向に前記ノズル手段を移動しながら当該ノズル手段から前記液滴を吐出することを特徴とする請求項７に記載の液晶表示装置の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】

この発明は、液晶表示装置の製造装置および製造方法に関し、さらに詳しくは、スペーサを含む液滴を基板の非画素領域内に収まるように塗布でき、表示品位の高い液晶表示装置を製造できる液晶表示装置の製造装置および製造方法に関する。

【０００２】

【従来の技術】

液晶表示装置は、基板の間隙を一定に保つために、基板間にたとえば球状のスペーサを配置している。このスペーサの配置手段として、キャリア溶液中に混入されたスペーサを、配向処理された基板上にスプレー散布する手段が知られている。なお、樹脂あるいはガラス等により形成された球状スペーサの直径は２～６μｍ程度であり、キャリア溶液としては、水とイソプロピルアルコール等の混合溶液が用いられている。

【０００３】

しかしながら、このスプレー散布では、スペーサが基板上に不均一に分布する場合があり、特に、表示に使用される領域（以下、「画素領域」と記す）に多数のスペーサが凝集すると、発色の明るさが減少したり、発色むらが生じ、表示品位が低下するという問題点があった。

【０００４】

このような問題点を解決するために、液滴吐出装置を用いることにより、表示に使用されない領域（以下、「非画素領域（ブラックマトリクス）」と記す）にスペーサを正確に吐出配置し、液晶表示装置のコントラスト向上を目指す手段が知られている（たとえば、特許文献１参照。）。図７は、このような従来の液滴吐出法（いわゆるインクジェット法）によってスペーサを吐出する様子を模式的に示す側面図、図８は、基板に吐出された液滴を示す平面図、図９は、基板に吐出された液滴の一例を示す拡大平面図である。

【０００５】

図７～図９に示すように、基板１０は、水平移動自在に形成された図示しないスライドテーブル上に水平に載置され、この基板１０の上方には、スペーサ１４を含む液滴１５を、基板１０の画素領域１１間に形成された非画素領域１２に向けて鉛直下方に吐出するためのノズル１３が設けられている。

【０００６】

このノズル１３は、非画素領域１２のピッチに対応させて、図示しない液滴吐出ヘッドに多数設けられており、上記スライドテーブルを所定量移動させながらノズル１３から液滴１５を吐出することにより、図８に示すように、非画素領域１２に液滴１５が配置される。

【特許文献１】

特開２００２－７２２１８号広報

【０００７】

【発明が解決しようとする課題】

しかしながら、非画素領域１２の幅は、通常、１０～２０μｍであり、ノズル１３から吐出され非画素領域１２に着弾した液滴１５は、図８および図９に示すように、平面形状が円形となり、その外径は２０～５０μｍとなる。

【０００８】

したがって、図８に示すように、非画素領域１２に配置された液滴１５は、非画素領域１２内に収まらず、画素領域１１側にはみ出してしまい、スペーサ１４が画素領域１１にも配置されてしまう場合がある。その結果、これが光抜けや黒点として認識され、液晶表示装置の発色の明るさが減少したり、発色むらが生じるという課題があった。

【０００９】

この発明は、上記に鑑みてなされたものであって、スペーサを含む液滴を基板の非画素領域内に収まるように塗布でき、表示品位の高い液晶表示装置を製造できる液晶表示装置の製造装置を提供することを目的とする。

【００１０】

また、この発明は、スペーサを含む液滴を基板の非画素領域内に収まるように塗布でき、表示品位の高い液晶表示装置を製造できる液晶表示装置の製造方法を提供することを目的とする。

【００１１】

【課題を解決するための手段】

上述の目的を達成するために、本発明にかかる液晶表示装置の製造装置は、スペーサを含む液滴を液滴吐出法を用いて基板に吐出し、当該スペーサを当該基板上に配置する液晶表示装置の製造装置において、前記基板を保持する基板保持手段と、前記基板の法線に対して一定角度傾斜させて配置され、前記スペーサを含む前記液滴を当該基板上の非画素領域に吐出するノズル手段と、前記基板または前記ノズル手段の少なくとも一方を所定量移動させる走査手段とを備え、前記ノズル手段から吐出され前記基板に付着した前記液滴が、前記非画素領域が延在する方向に沿って広がるように吐出するものである。

【００１２】

基板の法線に対して一定角度傾斜させて配置したノズル手段から液滴を吐出し、基板への着弾時における液滴の運動量の吐出方向水平成分を活用することができるので、非画素領域に付着した液滴の形状が、非画素領域が延在する方向に沿って広がる形状（たとえば、縦長の楕円形状）となる。

【００１３】

これにより、非画素領域が延在する方向の液滴の幅を小さくでき、非画素領域内に収まるように塗布できるので、スペーサが画素領域にも配置されるのを防止できる。したがって、光抜けや黒点として認識されるのを防止でき、液晶表示装置の発色の明るさが減少したり、発色むらが生じるということもない。

【００１４】

また、本発明にかかる液晶表示装置の製造装置は、ノズルの設置角度を任意に変更するノズル角可変手段を備えたものである。これにより、液滴の基板への着弾角度を容易かつ迅速に制御し、着弾時における液滴の運動量の吐出方向水平成分を活用し易くできる。したがって、非画素領域が延在する方向の液滴の幅を小さくでき、非画素領域内に収まるように塗布できるので、スペーサが画素領域にも配置されるのをさらに効果的に防止できる。

【００１５】

また、本発明にかかる液晶表示装置の製造装置は、ノズルの設置角度を基板の法線に対して－２０°～－８０°の範囲のうちのいずれかの角度、または＋２０°～＋８０°の範囲のうちのいずれかの角度としたものである。このように制御された液滴の基板への着弾角度によって、着弾時における液滴の運動量の吐出方向水平成分を活用し易くできる。したがって、非画素領域が延在する方向の液滴の幅を小さくでき、非画素領域内に収まるように確実に塗布できるので、表示品位の高い液晶表示装置を製造できる。

【００１６】

また、本発明にかかる液晶表示装置の製造装置は、ノズル手段の位置を固定し、液滴の運動量の吐出方向水平成分と逆方向に基板を走査しながら当該ノズル手段から液滴を吐出するものである。これにより、液滴の運動量の吐出方向水平成分をさらに活用し易くでき、液滴が基板に着弾した際に、非画素領域が延在する方向の液滴の幅を小さくできるので、非画素領域内に収まるように確実に塗布できる。

【００１７】

また、本発明にかかる液晶表示装置の製造装置は、基板の位置を固定し、液滴の運動量の吐出方向水平成分と同方向にノズル手段を走査しながら当該ノズル手段から液滴を吐出するものである。これにより、液滴の運動量の吐出方向水平成分をさらに活用し易くでき、液滴が基板に着弾した際に、非画素領域が延在する方向の液滴の幅を小さくできるので、

非画素領域内に収まるように確実に塗布できる。

【００１８】

また、本発明にかかる液晶表示装置の製造装置は、液滴の運動量の吐出方向水平成分と逆方向に基板を走査し、かつ、液滴の運動量の吐出方向水平成分と同方向にノズル手段を走査しながら当該ノズル手段から液滴を吐出するものである。これにより、液滴の運動量の吐出方向水平成分をさらに活用し易くでき、液滴が基板に着弾した際に、非画素領域が延在する方向の液滴の幅を小さくできるので、非画素領域内に収まるように確実に塗布できる。

【００１９】

また、本発明にかかる液晶表示装置の製造方法は、スペーサを含む液滴を液滴吐出法を用いて基板に吐出し、当該スペーサを当該基板上に配置する液晶表示装置の製造方法において、基板保持手段によって前記基板をほぼ水平状態で保持した後、前記基板の法線に対して一定角度傾斜させて配置されたノズル手段によって前記スペーサを含む液滴を当該基板上の非画素領域に吐出し、前記基板または前記ノズル手段の少なくとも一方を所定量移動させ、前記液滴の吐出行程を所定回数繰り返すことにより、前記スペーサを前記非画素領域に配置するようにしたものである。

【００２０】

ノズル手段を基板の法線に対して一定角度傾斜させているので、非画素領域に付着した液滴の形状は、基板への着弾時における液滴の運動量の吐出方向水平成分を活用することができ、非画素領域に付着した液滴の形状が、非画素領域が延在する方向に沿って広がる形状（たとえば、縦長の楕円形状）となる。

【００２１】

これにより、非画素領域が延在する方向の液滴の幅を小さくでき、非画素領域内に収まるように塗布できるので、スペーサが画素領域にも配置されるのを防止できる。したがって、光抜けや黒点として認識されるのを防止でき、液晶表示装置の発色の明るさが減少したり、発色むらが生じるということもない。

【００２２】

また、本発明にかかる液晶表示装置の製造方法は、ノズル手段の位置を固定し、液滴の運動量の吐出方向水平成分と逆方向に基板を走査しながら当該ノズル手段から液滴を吐出するものである。これにより、液滴の運動量の吐出方向水平成分をさらに活用し易くでき、液滴が基板に着弾した際に、非画素領域が延在する方向の液滴の幅を小さくできるので、非画素領域内に収まるように確実に塗布できる。

【００２３】

また、本発明にかかる液晶表示装置の製造方法は、基板の位置を固定し、液滴の運動量の吐出方向水平成分と同方向にノズル手段を走査しながら当該ノズル手段から液滴を吐出するものである。これにより、液滴の運動量の吐出方向水平成分をさらに活用し易くでき、液滴が基板に着弾した際に、非画素領域が延在する方向の液滴の幅を小さくできるので、非画素領域内に収まるように確実に塗布できる。

【００２４】

また、本発明にかかる液晶表示装置の製造方法は、液滴の運動量の吐出方向水平成分と逆方向に基板を走査し、かつ、液滴の運動量の吐出方向水平成分と同方向にノズル手段を走査しながら当該ノズル手段から液滴を吐出するものである。これにより、液滴の運動量の吐出方向水平成分をさらに活用し易くでき、液滴が基板に着弾した際に、非画素領域が延在する方向の液滴の幅を小さくできるので、非画素領域内に収まるように確実に塗布できる。

【００２５】

【発明の実施の形態】

以下、この発明にかかる液晶表示装置の製造装置の実施の形態につき図面を参照しつつ詳細に説明する。なお、この実施の形態によりこの発明が限定されるものではない。

【００２６】

図１は、この発明の実施の形態にかかる液晶表示装置の製造装置によってスペーサを吐出する様子を模式的に示す側面図、図２は、液晶表示装置の製造装置を示す正面図、図３は、ノズルの設置角度の定義を示す模式図、図４は、ノズルの設置角度とスペーサの配置状態（適合性）との関係を示す表図、図５は、基板に吐出された液滴を示す平面図、図６は、基板に吐出された液滴の一例を示す拡大平面図である。なお、以下の説明において、すでに説明した部材と同一もしくは相当する部材には、同一の符号を付して重複説明を省略または簡略化する。

【００２７】

本実施の形態にかかる発明は、図１に示すように、基板１０をほぼ水平にした状態で傾斜設置したノズル１３から液滴１５を吐出し、基板１０への着弾時における液滴１５の運動量の吐出方向水平成分を活用することにより、基板１０の非画素領域１２に付着した液滴１５の形状が、非画素領域１２が延在する方向に沿って広がる形状（たとえば、縦長の楕円形状）となるようにしたものである。

【００２８】

すなわち、非画素領域１２が延在する方向の液滴１５の幅を小さくし、非画素領域１２内に収まるように塗布するようにしたものである。なお、上記楕円形状とは、数学的に厳密な楕円形状のみを指すものではなく、非画素領域１２内に収まるような形状であればよい。

【００２９】

図１および図２に示すように、スペーサ１４を含む液滴１５を基板１０の所定位置に吐出するための液晶表示装置の製造装置は、基板１０を保持し水平方向に移動自在に形成されたステージ１６と、必要に応じてステージ１６（基板１０）の設置角度を任意に変化させる基板角可変機構２０を備え、当該ステージ１６等を保持する基台１７と、多数のノズル１３を備えた液滴吐出ヘッド１８と、液滴吐出ヘッド１８を回転させ、ノズル１３の設置角度を任意に変化させるノズル角可変機構２１とを備えて構成されている。

【００３０】

このノズル１３と基板１０間の距離は、ステージ１６の移動後も一定に保持されている。なお、図中の矢印ａは、基板１０およびステージ１６の進行方向を示している。また、ノズル１３の設置角度は、図３に示すように、基板１０の法線に対する角度φとして定義している。

【００３１】

なお、樹脂あるいはガラス、セラミック等により形成された球状スペーサ１４は、製造する液晶表示装置の性能等によって異なるが、たとえば直径が２～６μｍ程度のものを用いることができる。スペーサ１４は、粒状であれば、球状以外の形状であってもよく、たとえば円筒状で直径と高さがほぼ等しいものを用いることもできる。

【００３２】

また、キャリア溶液としては、たとえば水とエチレングリコールの混合溶液（粘度が１０～４０ｍＰＡ・ｓ、沸点が１５０～２５０℃程度のもの）を用いることができるが、スペーサ１４を適切に配置できるものであれば、これに限定されず、その他の溶液であってもよい。たとえば、このキャリア溶液は、水とエチレングリコールの混合溶液にさらに他の溶液（たとえば、１－デカノール、または１－ドデカノール）を加えて上記物性値をとり得るものであってもよい。また、液滴吐出ヘッド１８は、ノズル１３から固形物であるスペーサ１４を吐出するので、圧電素子により駆動されるものが好ましい。

【００３３】

以上のような構成により、図４に示すように、ノズル１３の設置角度φを種々変化させ、スペーサ１４が良好に配置される角度範囲を検証したところ、その適合性が確認できた。図中では、適合する場合を○、適合しない場合を×、適合するか否かがあいまいな場合を△で示してある。

【００３４】

すなわち、本発明は、ノズル１３の設置角度φは、基板１０の法線に対しておよそ－２０

°～－８０°、＋２０°～＋８０°の範囲で有効であることが確認できた。これは、傾斜設置したノズル１３から液滴１５を吐出し、基板１０への着弾時における液滴１５の運動量の吐出方向水平成分を活用することにより、基板１０の非画素領域１２に付着した液滴１５の形状が、非画素領域１２が延在する方向に沿って広がる形状（たとえば、縦長の楕円形状）となるように形成したからである。また、ノズル１３の設置位置を固定し、液滴１５の運動量の吐出方向水平成分と逆方向（図１中の矢印ａ方向）にステージ１６（基板１０）を走査しながら当該ノズル１３から液滴１５を吐出するようにしたので、液滴１５の運動量の吐出方向水平成分をさらに活用し易くできる。

【００３５】

これにより、図５および図６に示すように、非画素領域１２が延在する方向の液滴１５の幅を小さくでき、非画素領域１２内に収まるように塗布できるので、スペーサ１４が画素領域１１にも配置されるのを防止できる。したがって、光抜けや黒点として認識されるのを防止でき、液晶表示装置の発色の明るさが減少したり、発色むらが生じるということもない。

【００３６】

以上のように、この実施の形態にかかる液晶表示装置の製造装置によれば、基板１０に付着した液滴１５の形状が非画素領域１２に沿って広がる形状となるように助長することができ、非画素領域１２内に収まり易くなるように塗布できるので、表示品位の高い液晶表示装置を製造できる。

【００３７】

なお、上記実施の形態においては、液滴吐出ヘッド１８の位置をノズル１３の設置角度一定で固定し、基板１０を保持したステージ１６側を図１中の矢印ａ方向（液滴１５の運動量の吐出方向水平成分と逆方向）に移動しながらスペーサ１４を吐出するものとして説明したが、これに限定されず、たとえば、基板１０を保持したステージ１６の位置を固定し、液滴吐出ヘッド１８側を図１中の矢印ｂ方向（液滴１５の運動量の吐出方向水平成分と同方向）に移動しながらスペーサ１４を吐出する構成としてもよい。

【００３８】

あるいは、液滴１５の運動量の吐出方向水平成分と逆方向に基板１０を走査し、かつ、液滴１５の運動量の吐出方向水平成分と同方向に液滴吐出ヘッド１８を走査しながら当該液滴吐出ヘッド１８から液滴１５を吐出する構成としてもよい。液滴１５の運動量の吐出方向水平成分をさらに活用し易くできる。

【００３９】

このように構成することで、液滴１５の運動量の吐出方向水平成分をさらに活用し易くでき、非画素領域１２が延在する方向の液滴１５の幅を小さくできるので、非画素領域１２内に収まり易くなるように塗布できる。なお、これらの移動走査は、吐出する液滴１５がすでに基板１０に配置された液滴１５と干渉しないようにすることは言うまでもない。

【００４０】

また、上記実施の形態においては、液滴１５を基板１０の上方から吐出するものとして説明したが、これに限定されず、ノズル１３を基板１０の下方に所定傾斜角度で設置し、基板１０の下方から液滴１５を吐出してもよい。この場合、基板１０に付着した液滴１５には、下向きの重力成分がかかるので、これと液滴１５の表面張力や基板１０の濡れ性等の物性を勘案して、ノズル１３の設置角度を設定すればよい。

【図面の簡単な説明】

【図１】スペーサを吐出する様子を模式的に示す側面図。

【図２】液晶表示装置の製造装置を示す正面図。

【図３】ノズルの設置角度の定義を示す模式図。

【図４】ノズル設置角度とスペーサ配置状態との関係を示す表図。

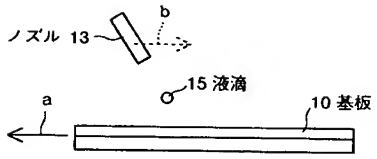
【図５】基板に吐出された液滴を示す平面図。

【図６】基板に吐出された液滴の一例を示す拡大平面図。

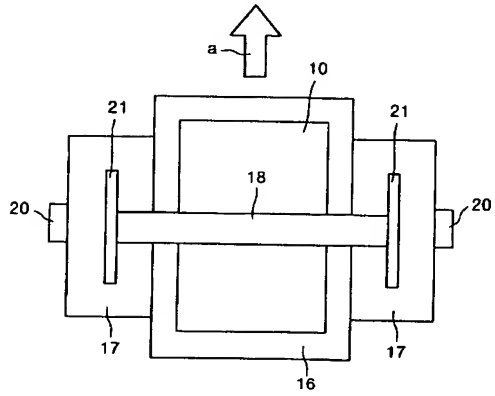
【図７】従来のスペーサを吐出する様子を模式的に示す側面図。

【図８】基板に吐出された液滴を示す平面図。
【図９】基板に吐出された液滴の一例を示す拡大平面図。
【符号の説明】
１０　基板
１１　画素領域
１２　非画素領域
１３　ノズル
１４　スペーサ
１５　液滴
１６　ステージ
１７　基台
１８　液滴吐出ヘッド
１９　ヘッド回転機構
２０　基板角可変機構
２１　ノズル角可変機構

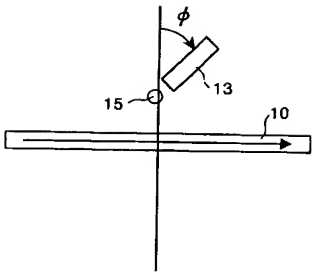
【図１】



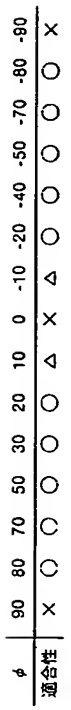
【図２】



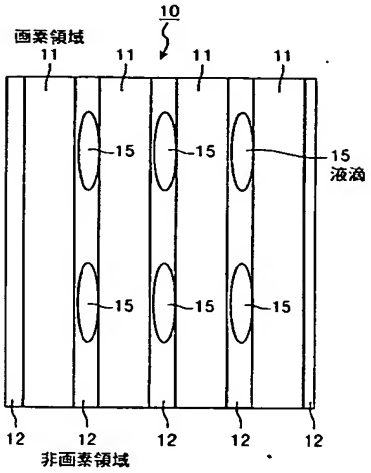
【図３】



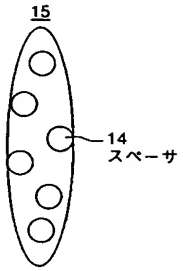
【図４】



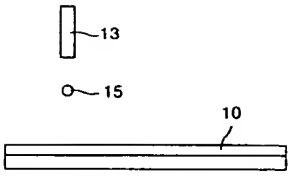
【図５】



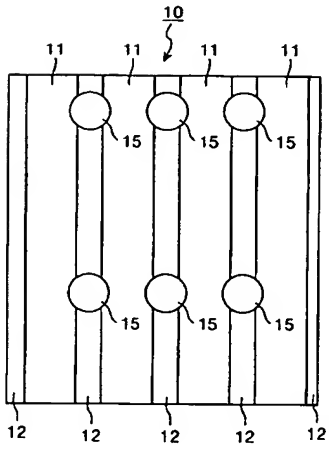
【図６】



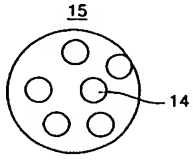
【図７】



【図８】



【図９】



フロントページの続き

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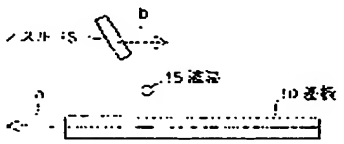
(54) APPARATUS AND METHOD FOR MANUFACTURING LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for manufacturing a liquid crystal display device by which a liquid drop including spacers is applied in the non-pixel region of a substrate and the liquid crystal display device with high display quality is manufactured, and to provide an apparatus therefor.
SOLUTION: The substrate 10 is held in a nearly horizontal state and the liquid drop 15 including the spacers 14 is discharged to the non-pixel region 12 on the substrate 10 by a nozzle 13 installed to be inclined. The substrate 10 is transferred with a specified pitch for every discharge process, and the liquid drop is discharged so that the liquid drop 15 deposited on the substrate 10 becomes almost elliptical shape in the direction where the non-pixel region 12 extends.



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CLAIMS

[Claim(s)]
[Claim 1]
In the manufacturing installation of the liquid crystal display which arranges discharge and the spacer concerned for the drop containing a spacer on the substrate concerned to a substrate using a drop regurgitation method,
A substrate maintenance means to hold said substrate in the level condition mostly,
The nozzle means which is made to carry out a fixed include-angle inclination to the normal of said substrate, and carries out the regurgitation of said drop which is arranged and contains said spacer to the non-pixel field on the substrate concerned,
A scan means to carry out specified quantity migration of either [at least] said substrate or said nozzle means,
Preparation,
The manufacturing installation of the liquid crystal display characterized by carrying out the regurgitation so that said drop which was breathed out from said nozzle means and adhered to said substrate may spread along the direction where said non-pixel field extends.
[Claim 2]
The manufacturing installation of the liquid crystal display according to claim 1 characterized by having a nozzle angle adjustable means to change the installation include angle of said nozzle into arbitration.
[Claim 3]
The manufacturing installation of the liquid crystal display according to claim 1 or 2 characterized by making the installation include angle of said nozzle into the include angle of either of the range of -20 degrees - -80 degrees, or the include angle of either of the range of +20 degrees - +80 degrees to the normal of a substrate.
[Claim 4]
The manufacturing installation of the liquid crystal display of any one publication of claim 1-3 characterized by carrying out the regurgitation of said drop from the nozzle means concerned, fixing the location of said nozzle means and moving said substrate to the discharge direction horizontal component and hard flow of momentum of said drop.
[Claim 5]
The manufacturing installation of the liquid crystal display of any one publication of claim 1-3 characterized by carrying out the regurgitation of said drop from the nozzle means concerned, fixing the location of said substrate and moving said nozzle means in momentum the discharge direction horizontal component and this direction of said drop.
[Claim 6]
The manufacturing installation of the liquid crystal display of any one publication of claim 1-3 characterized by carrying out the regurgitation of said drop from the nozzle means concerned, moving said substrate to the discharge direction horizontal component and hard flow of momentum of said drop, and moving said nozzle means in momentum the discharge direction horizontal component and this direction of said drop.
[Claim 7]
In the manufacture approach of the liquid crystal display which arranges discharge and the spacer concerned for the drop containing a spacer on the substrate concerned to a substrate using a drop regurgitation method,

After holding said substrate in the level condition mostly with a substrate maintenance means, It is discharge to the non-pixel field on the substrate concerned about said drop which contains said spacer with the nozzle means which was made to carry out a fixed include-angle inclination to the normal of said substrate, and has been arranged,
The manufacture approach of the liquid crystal display characterized by arranging said spacer to said non-pixel field by carrying out specified quantity migration of either [at least] said substrate or said nozzle means, and repeating the regurgitation stroke of said drop the number of predetermined times.
[Claim 8]
The manufacture approach of the liquid crystal display according to claim 7 characterized by carrying out the regurgitation of said drop from the nozzle means concerned, fixing the location of said nozzle means and moving said substrate to the discharge direction horizontal component and hard flow of momentum of said drop.
[Claim 9]
The manufacture approach of the liquid crystal display according to claim 7 characterized by carrying out the regurgitation of said drop from the nozzle means concerned, fixing the location of said substrate and moving said nozzle means in momentum the discharge direction horizontal component and this direction of a drop.
[Claim 10]
The manufacture approach of the liquid crystal display according to claim 7 characterized by carrying out the regurgitation of said drop from the nozzle means concerned, moving said substrate to the discharge direction horizontal component and hard flow of momentum of said drop, and moving said nozzle means in momentum the discharge direction horizontal component and this direction of said drop.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
About the manufacturing installation and the manufacture approach of a liquid crystal display, in more detail, this invention can apply the drop containing a spacer so that it may be settled in the non-pixel field of a substrate, and it relates to the manufacturing installation and the manufacture approach of a liquid crystal display that the high liquid crystal display of display grace can be manufactured.
[0002]
[Description of the Prior Art]
The liquid crystal display arranges the spherical spacer between substrates, for example, in order to keep the gap of a substrate constant. The means which carries out spray spraying of the spacer mixed into the carrier solution as an arrangement means of this spacer on the substrate by which orientation processing was carried out is known. In addition, the diameter of the spherical spacer formed with resin or glass is about 2-6 micrometers, and water and mixed solutions, such as isopropyl alcohol, are used as a carrier solution.
[0003]
However, in this spray spraying, when many spacers condensed to the field (it is hereafter described as a "pixel field") which a spacer may be distributed on a substrate at an ununiformity and is especially used for a display, the brightness of coloring decreased, or coloring unevenness arose, and there was a trouble that display grace fell.
[0004]
In order to solve such a trouble, by using drop regurgitation equipment, regurgitation arrangement of the spacer is correctly carried out to the field (it is hereafter described as "a non-pixel field (black matrix)") which is not used for a display, and a means to aim at the improvement in contrast of a liquid crystal display is known (for example, patent reference 1 reference.). The top view showing the drop by which the side elevation showing typically signs that drawing 7 carries out the regurgitation of the spacer by such conventional drop regurgitation method (the so-called ink jet method), and drawing 8 were breathed out by the substrate, and drawing 9 are the expansion top views showing an example of the drop breathed out by the substrate.
[0005]
As shown in drawing 7 - drawing 9 , a substrate 10 is laid horizontally on the slide table which was formed free [horizontal migration] and which is not illustrated, and the nozzle 13 for carrying out the regurgitation of the drop 15 containing a spacer 14 to a vertical lower part towards the non-pixel field 12 formed between the pixel fields 11 of a substrate 10 is formed above this substrate 10.
[0006]
This nozzle 13 is made to correspond to the pitch of the non-pixel field 12, a large number are prepared in the drop discharge head which is not illustrated, and carrying out specified quantity migration of the above-mentioned slide table, by carrying out the regurgitation of the drop 15 from a nozzle 13, as shown in drawing 8 , a drop 15 is arranged to the non-pixel field 12.
[Patent reference 1]
JP,2002-72218,A public relations
[0007]

[Problem(s) to be Solved by the Invention]
However, as the drop 15 which the width of face of the non-pixel field 12 is usually 10-20 micrometers, was breathed out from the nozzle 13, and reached the non-pixel field 12 is shown in drawing 8 and drawing 9 , a flat-surface configuration becomes circular and the outer diameter is set to 20-50 micrometers.
[0008]
Therefore, as shown in drawing 8 , the drop 15 arranged to the non-pixel field 12 is not settled in the non-pixel field 12, but is protruded into the pixel field 11 side, and a spacer 14 may be arranged also to the pixel field 11. Consequently, this has been recognized as an optical omission or a sunspot and the technical problem that the brightness of coloring of a liquid crystal display decreased, or coloring unevenness arose occurred.
[0009]
This invention is made in view of the above, it can apply the drop containing a spacer so that it may be settled in the non-pixel field of a substrate, and it aims at offering the manufacturing installation of a liquid crystal display which can manufacture the high liquid crystal display of display grace.
[0010]
Moreover, this invention can apply the drop containing a spacer so that it may be settled in the non-pixel field of a substrate, and it aims at offering the manufacture approach of a liquid crystal display that the high liquid crystal display of display grace can be manufactured.
[0011]
[Means for Solving the Problem]
In order to attain the above-mentioned purpose, the manufacturing installation of the liquid crystal display concerning this invention In the manufacturing installation of the liquid crystal display which arranges discharge and the spacer concerned for the drop containing a spacer on the substrate concerned to a substrate using a drop regurgitation method A substrate maintenance means to hold said substrate, and the nozzle means which carries out the regurgitation of said drop which is made to carry out a fixed include-angle inclination to the normal of said substrate, is arranged, and contains said spacer to the non-pixel field on the substrate concerned, It has a scan means to carry out specified quantity migration of either [at least] said substrate or said nozzle means, and the regurgitation is carried out so that said drop which was breathed out from said nozzle means and adhered to said substrate may spread along the direction where said non-pixel field extends.
[0012]
Since the discharge direction horizontal component of the momentum of the drop [drop] at the time of the impact to discharge and a substrate is utilizable from the nozzle means which was made to carry out a fixed include-angle inclination to the normal of a substrate, and has been arranged, the configuration of the drop adhering to a non-pixel field turns into a configuration (for example, elliptical [longwise]) which spreads along the direction where a non-pixel field extends.
[0013]
Width of face of the drop of the direction where a non-pixel field extends can be made small by this, and since it can apply so that it may be settled in a non-pixel field, a spacer can prevent being arranged also to a pixel field. Therefore, it can prevent being recognized as an optical omission or a sunspot, and the brightness of coloring of a liquid crystal display does not decrease, or coloring unevenness does not necessarily arise.
[0014]
Moreover, the manufacturing installation of the liquid crystal display concerning this invention is equipped with a nozzle angle adjustable means to change the installation include angle of a nozzle into arbitration. The discharge direction horizontal component of the momentum of the drop at the time of impact can be made easy to control the impact include angle to the substrate of a drop easily and quickly, and to utilize by this. Therefore, width of face of the drop of the direction where a non-pixel field extends can be made small, and since it can apply so that it may be settled in a non-pixel field, a spacer can prevent being arranged also to a pixel field still more effectively.
[0015]
Moreover, the manufacturing installation of the liquid crystal display concerning this invention makes the installation include angle of a nozzle the include angle of either of the range of -20

degrees - -80 degrees, or the include angle of either of the range of +20 degrees - +80 degrees to the normal of a substrate. Thus, the discharge direction horizontal component of the momentum of the drop at the time of impact can be made easy to utilize with the impact include angle to the controlled substrate of a drop. Therefore, width of face of the drop of the direction where a non-pixel field extends can be made small, and since it can apply certainly so that it may be settled in a non-pixel field, the high liquid crystal display of display grace can be manufactured.

[0016]

Moreover, the manufacturing installation of the liquid crystal display concerning this invention fixes the location of a nozzle means, and it carries out the regurgitation of the drop from the nozzle means concerned, scanning a substrate to the discharge direction horizontal component and hard flow of momentum of a drop. Thereby, the discharge direction horizontal component of the momentum of a drop can be made further easy to utilize, and since width of face of the drop of the direction where a non-pixel field extends can be made small when a drop reaches a substrate, it can apply certainly so that it may be settled in a non-pixel field.

[0017]

Moreover, the manufacturing installation of the liquid crystal display concerning this invention fixes the location of a substrate, and it carries out the regurgitation of the drop from the nozzle means concerned, scanning a nozzle means in momentum the discharge direction horizontal component and this direction of a drop. Thereby, the discharge direction horizontal component of the momentum of a drop can be made further easy to utilize, and since width of face of the drop of the direction where a non-pixel field extends can be made small when a drop reaches a substrate, it can apply certainly so that it may be settled in a non-pixel field.

[0018]

Moreover, the manufacturing installation of the liquid crystal display concerning this invention carries out the regurgitation of the drop from the nozzle means concerned, scanning a substrate to the discharge direction horizontal component and hard flow of momentum of a drop, and scanning a nozzle means in momentum the discharge direction horizontal component and this direction of a drop. Thereby, the discharge direction horizontal component of the momentum of a drop can be made further easy to utilize, and since width of face of the drop of the direction where a non-pixel field extends can be made small when a drop reaches a substrate, it can apply certainly so that it may be settled in a non-pixel field.

[0019]

Moreover, the manufacture approach of the liquid crystal display concerning this invention In the manufacture approach of the liquid crystal display which arranges discharge and the spacer concerned for the drop containing a spacer on the substrate concerned to a substrate using a drop regurgitation method After holding said substrate in the level condition mostly with a substrate maintenance means, the drop which contains said spacer with the nozzle means which was made to carry out a fixed include-angle inclination to the normal of said substrate, and has been arranged to the non-pixel field on the substrate concerned Discharge, Said spacer is arranged to said non-pixel field by carrying out specified quantity migration of either [at least] said substrate or said nozzle means, and repeating the regurgitation stroke of said drop the number of predetermined times.

[0020]

Since the fixed include-angle inclination of the nozzle means is carried out to the normal of a substrate, the configuration of the drop adhering to a non-pixel field can utilize the discharge direction horizontal component of the momentum of the drop at the time of the impact to a substrate, and turns into a configuration (for example, elliptical [longwise]) in which the configuration of the drop adhering to a non-pixel field spreads along the direction where a non-pixel field extends.

[0021]

Width of face of the drop of the direction where a non-pixel field extends can be made small by this, and since it can apply so that it may be settled in a non-pixel field, a spacer can prevent being arranged also to a pixel field. Therefore, it can prevent being recognized as an optical omission or a sunspot, and the brightness of coloring of a liquid crystal display does not decrease, or coloring unevenness does not necessarily arise.

[0022]

Moreover, the manufacture approach of the liquid crystal display concerning this invention fixes the location of a nozzle means, and it carries out the regurgitation of the drop from the nozzle means concerned, scanning a substrate to the discharge direction horizontal component and hard flow of momentum of a drop. Thereby, the discharge direction horizontal component of the momentum of a drop can be made further easy to utilize, and since width of face of the drop of the direction where a non-pixel field extends can be made small when a drop reaches a substrate, it can apply certainly so that it may be settled in a non-pixel field.

[0023]

Moreover, the manufacture approach of the liquid crystal display concerning this invention fixes the location of a substrate, and it carries out the regurgitation of the drop from the nozzle means concerned, scanning a nozzle means in momentum the discharge direction horizontal component and this direction of a drop. Thereby, the discharge direction horizontal component of the momentum of a drop can be made further easy to utilize, and since width of face of the drop of the direction where a non-pixel field extends can be made small when a drop reaches a substrate, it can apply certainly so that it may be settled in a non-pixel field.

[0024]

Moreover, the manufacture approach of the liquid crystal display concerning this invention carries out the regurgitation of the drop from the nozzle means concerned, scanning a substrate to the discharge direction horizontal component and hard flow of momentum of a drop, and scanning a nozzle means in momentum the discharge direction horizontal component and this direction of a drop. Thereby, the discharge direction horizontal component of the momentum of a drop can be made further easy to utilize, and since width of face of the drop of the direction where a non-pixel field extends can be made small when a drop reaches a substrate, it can apply certainly so that it may be settled in a non-pixel field.

[0025]

[Embodiment of the Invention]

It explains to a detail, referring to a drawing hereafter per gestalt of operation of the manufacturing installation of the liquid crystal display concerning this invention. In addition, this invention is not limited by the gestalt of this operation.

[0026]

The side elevation and drawing 2 which show typically signs that drawing 1 carries out the regurgitation of the spacer by the manufacturing installation of the liquid crystal display concerning the gestalt of implementation of this invention The front view and drawing 3 which show the manufacturing installation of a liquid crystal display The top view showing the drop by which front drawing in which the mimetic diagram showing the definition of the installation include angle of a nozzle and drawing 4 show the relation between the installation include angle of a nozzle and the arrangement condition (compatibility) of a spacer, and drawing 5 were breathed out by the substrate, and drawing 6 are the expansion top views showing an example of the drop breathed out by the substrate. In addition, in the following explanation, the sign same to a corresponding member identically to the already explained member is attached, and duplication explanation is omitted or simplified.

[0027]

Invention concerning the gestalt of this operation by utilizing the discharge direction horizontal component of the momentum of the drop [drop / 15] 15 at the time of the impact to discharge and a substrate 10 from the nozzle 13 which carried out inclination installation of the substrate 10 in the condition of having leveled mostly, as shown in drawing 1 It is made for the configuration of the drop 15 adhering to the non-pixel field 12 of a substrate 10 to turn into a configuration (for example, elliptical [longwise]) which spreads along the direction where the non-pixel field 12 extends.

[0028]

That is, width of face of the drop 15 of the direction where the non-pixel field 12 extends is made small, and it is made to apply so that it may be settled in the non-pixel field 12. In addition, the above-mentioned elliptical one should just be a configuration which does not point out elliptical [strict] mathematically and is settled in the non-pixel field 12.

[0029]

The manufacturing installation of the liquid crystal display for carrying out the regurgitation of the

drop 15 containing a spacer 14 to the predetermined location of a substrate 10, as shown in drawing 1 and drawing 2 The stage 16 which held the substrate 10 and was formed horizontally free [migration], The pedestal 17 which is equipped with the substrate angle adjustable device 20 in which the installation include angle of a stage 16 (substrate 10) is changed to arbitration if needed, and holds the stage 16 grade concerned, The drop discharge head 18 equipped with many nozzles 13 and the drop discharge head 18 are rotated, and it has the nozzle angle adjustable device 21 in which the installation include angle of a nozzle 13 is changed to arbitration, and is constituted.

[0030]

As for the distance between this nozzle 13 and a substrate 10, after migration of a stage 16 is held uniformly. In addition, the arrow head a in drawing shows the travelling direction of a substrate 10 and a stage 16. Moreover, the installation include angle of a nozzle 13 is defined as an include angle phi to the normal of a substrate 10, as shown in drawing 3 .

[0031]

In addition, although the spherical spacer 14 formed of resin or glass, a ceramic, etc. changes with engine performance of the liquid crystal display to manufacture etc., that whose diameter is about 2-6 micrometers, for example can be used for it. If the spacer 14 is granular, you may be a configuration except spherical, for example, it is cylindrical and a diameter and height can also use an equal mostly.

[0032]

Moreover, as a carrier solution, although water and the mixed solution (thing whose viscosity is 10 - 40 mPA-s and whose boiling point is about 150-250 degrees C) of ethylene glycol can be used, for example, as long as it can arrange a spacer 14 appropriately, it may not be limited to this but you may be other solutions. For example, this carrier solution adds the solution (for example, 1-decanol or 1-dodecanol) of further others to water and the mixed solution of ethylene glycol, and can take the above-mentioned physical-properties value. Moreover, since the drop discharge head 18 carries out the regurgitation of the spacer 14 which is a solid from a nozzle 13, what is driven by the piezoelectric device is desirable.

[0033]

By the above configurations, as shown in drawing 4 , the installation include angle phi of a nozzle 13 was changed variously, and when the include-angle range where a spacer 14 is arranged good was verified, the compatibility has been checked. All over drawing, O shows the case where it suits and ** has shown the case being x and where it is ambiguous whether it suits or not for the case where it does not suit.

[0034]

That is, for this invention, the installation include angle phi of a nozzle 13 is [about] to the normal of a substrate 10. -The effective thing has been checked in 20 degrees - -80 degrees and +20 degrees - +80 degrees. This is because it formed so that the configuration of the drop 15 adhering to the non-pixel field 12 of a substrate 10 might turn into a configuration (for example, elliptical [longwise]) which spreads along the direction where the non-pixel field 12 extends by utilizing the discharge direction horizontal component of the momentum of the drop [drop / 15] 15 at the time of the impact to discharge and a substrate 10 from the nozzle 13 which carried out inclination installation. Moreover, since it was made to carry out the regurgitation of the drop 15 from the nozzle 13 concerned, having fixed the installation location of a nozzle 13 and scanning a stage 16 (substrate 10) to the discharge direction horizontal component and hard flow (the direction of arrow-head a in drawing 1) of momentum of a drop 15, the discharge direction horizontal component of the momentum of a drop 15 can be made further easy to utilize.

[0035]

Since it can apply by this so that width of face of the drop 15 of the direction where the non-pixel field 12 extends can be made small and it may be settled in the non-pixel field 12 as shown in drawing 5 and drawing 6 , a spacer 14 can prevent being arranged also to the pixel field 11. Therefore, it can prevent being recognized as an optical omission or a sunspot, and the brightness of coloring of a liquid crystal display does not decrease, or coloring unevenness does not necessarily arise.

[0036]

As mentioned above, since according to the manufacturing installation of the liquid crystal display

concerning the gestalt of this operation it can apply so that it can promote so that the configuration of the drop 15 adhering to a substrate 10 may turn into a configuration which spreads along the non-pixel field 12, and it may be easy to be settled in the non-pixel field 12 and it may become, the high liquid crystal display of display grace can be manufactured.

[0037]

In addition, in the gestalt of the above-mentioned implementation, the location of the drop discharge head 18 is fixed by installation include-angle regularity of a nozzle 13. Although the spacer 14 was explained as what carries out the regurgitation, moving the stage 16 side holding a substrate 10 in the direction of arrow-head a in drawing 1 (the discharge direction horizontal component and hard flow of momentum of a drop 15) It is good also as a configuration which carries out the regurgitation of the spacer 14, fixing the location of the stage 16 which was not limited to this, for example, held the substrate 10, and moving the drop discharge-head 18 side in the direction of arrow-head b in drawing 1 (the discharge direction horizontal component and this direction of momentum of a drop 15).

[0038]

Or it is good also as a configuration which carries out the regurgitation of the drop 15 from the drop discharge head 18 concerned, scanning a substrate 10 to the discharge direction horizontal component and hard flow of momentum of a drop 15, and scanning the drop discharge head 18 in momentum the discharge direction horizontal component and this direction of a drop 15. The discharge direction horizontal component of the momentum of a drop 15 can be made further easy to utilize.

[0039]

Thus, since width of face of the drop 15 of the direction where the discharge direction horizontal component of the momentum of a drop 15 can be made further easy to utilize, and the non-pixel field 12 extends with constituting can be made small, it can apply so that it may be easy to be settled in the non-pixel field 12 and may become. In addition, it cannot be overemphasized that it is made for the drop 15 which carries out the regurgitation not to interfere in these migration scans with the drop 15 already arranged at the substrate 10.

[0040]

Moreover, in the gestalt of the above-mentioned implementation, although explained as what carries out the regurgitation of the drop 15 from the upper part of a substrate 10, it may not be limited to this, but a nozzle 13 may be installed by whenever [predetermined tilt-angle] under the substrate 10, and a drop 15 may be breathed out from the lower part of a substrate 10. In this case, what is necessary is to take into consideration physical properties, such as surface tension of this and a drop 15, and the wettability of a substrate 10, in the drop 15 adhering to a substrate 10, and just to set the installation include angle of a nozzle 13 to it, since a downward gravity component starts.

[Brief Description of the Drawings]

[Drawing 1] The side elevation showing typically signs that the regurgitation of the spacer is carried out.

[Drawing 2] The front view showing the manufacturing installation of a liquid crystal display.

[Drawing 3] The mimetic diagram showing the definition of the installation include angle of a nozzle.

[Drawing 4] Front drawing showing the relation between a nozzle installation include angle and a spacer arrangement condition.

[Drawing 5] The top view showing the drop breathed out by the substrate.

[Drawing 6] The expansion top view showing an example of the drop breathed out by the substrate.

[Drawing 7] The side elevation showing typically signs that the regurgitation of the conventional spacer is carried out.

[Drawing 8] The top view showing the drop breathed out by the substrate.

[Drawing 9] The expansion top view showing an example of the drop breathed out by the substrate.

[Description of Notations]

10 Substrate

11 Pixel Field

12 Non-Pixel Field
13 Nozzle
14 Spacer
15 Drop
16 Stage
17 Pedestal
18 Drop Discharge Head
19 Head Rolling Mechanism
20 Substrate Angle Adjustable Device
21 Nozzle Angle Adjustable Device

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

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11 Pixel Field
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